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EXAMINER

MAGEE, THOMAS J

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 01/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/915,145

Applicant(s)

NOGAMI ET AL.

Examiner

Thomas J. Magee

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 22 October 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-9, and 11-13 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 and 11-13 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Reopening of Prosecution***

1. In view of the Appeal Brief filed on 22 October 2004, PROSECUTION IS HEREBY RE-OPENED. New grounds of rejection are set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

### ***Claim Objections***

2. Claim 1 is objected to on the basis of a minor informality. The limitation, "a cobalt including layer having oxidation resistive and fluorinated acid resistive properties," appears to be a typographical insertion error. In the Specification, Applicant recites (p.3, lines 9 – 10, 30 – 32, p. 5, lines 10 –12) "a cobalt silicide for cladding .... having oxidation resistive and fluorinated acid resistive nature." Therefore, the clad layer has the resistive properties and not the cobalt including layer. Correction is required.

Art Unit: 2811

Examiner will assume for the purposes of examination that the clad layer has oxidation resistive and fluorinated acid resistive properties.

***Claim Rejections – 35 U.S.C. 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1 – 4, 8, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US 6,259,160 B1) in view of Levinstein et al. (US 4,378,628),

Lopatin et al. disclose a structure containing a copper conductive member (40,53) (See Figure 4) with a cobalt including layer (60) (Col. 5, lines 52 – 58) (CoWP) on top of the copper conductive (wiring) member.

Lopatin et al. do not disclose a clad layer formed over the cobalt layer for cladding said cobalt including layer, having oxidation resistance and fluorinated acid resistance. Levinstein et al. disclose a clad (“outer cover”) layer (cobalt silicide) (Col. 4, lines 15 – 19). Cobalt silicide is known to be oxidation resistive and fluorinated acid resistive.

Additionally, Lopatin et al. do not disclose a layer including oxygen over the clad layer.

Levinstein et al. disclose (Col. 6, lines 42 – 43) the presence of an oxygen bearing layer

Art Unit: 2811

(silicon dioxide) on the cobalt silicide. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine Levinstein et al. with Lopatin et al. to obtain a device with a protective cover atop to avoid damage.

4. Claims 5, 7, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. in view of Besser et al. (US 6,165,903), and Fowler (US 3,617, 399).

5. Regarding Claims 5, 7, and 11, Lopatin et al. disclose a method for manufacturing a semiconductor device comprising the steps of:

forming a cobalt including layer (60) (Col. 5, lines 52 – 58) (CoWP) on top of the copper conductive (wiring) member (40,53) (See Figure 4).

Lopatin et al. do not disclose the formation of a cobalt silicide layer in a single step on the surface of the CoWP layer, wherein said cobalt silicide layer is formed by exposing said cobalt including layer in a silane system gas such that the source of the cobalt is the cobalt including layer and the source of the silicon is the silane gas. The formation of silicon in a silane gas (CVD) system is well established in the art. Fowler et al., for example disclose the use of silane gas in a system as a source of silicon (Col. 3, lines 15 – 23) for deposition. Further, Besser et al. disclose the formation of a cobalt silicide layer on a surface of a cobalt including layer (44) (Figure 8) in a single processing step in a CVD system (Col. 5, lines 36 – 40) using a heated substrate (Col. 5, lines 37 – 38) such that the source of the cobalt is the cobalt including layer (44) and the source of the silicon is the CVD system (Col. 3, lines 1 –

Art Unit: 2811

4). It would have therefore been obvious to one of ordinary skill in the art at the time of the invention to combine Besser et al. and Fowler et al. with Lopatin et al. to obtain a process stable layer over the cobalt including layer for device stability.

6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. in view of Levinstein et al., and Fowler et al., as applied to Claims 5, 7, and 11, and further in view of Sherman ("Chemical Vapor Deposition for Microelectronics," Noyes Publ., Westwood, New Jersey, (1987) pp. 66 – 67).

Lopatin et al. do not disclose the formation of a silicon oxide by adding oxygen to silane in a reaction process. However, the formation of silicon oxide on a semiconductor surface using a mixture of silane and oxygen in a reaction process has been utilized for many decades and is notoriously well known in the art (See for example, Sherman, p. 67, 1<sup>st</sup> par.) Hence, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Sherman with Lopatin et al. to obtain a silicon oxide layer formed by an oxygen/silane reaction for use as a passivation or scratch protection layer (p. 66, 2<sup>nd</sup> par) on the cobalt silicide.

Lopatin et al. do not disclose the presence of a cobalt silicide or a layer including oxygen over the silicide layer. Rhodes discloses a cobalt silicide layer (339) (Figure 13) with an oxide (Col. 12, lines 54 – 65) (359) layer formed atop. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine Rhodes with Lopatin et al. to obtain a device

with a process stable layer over the CoWP and a protective cover atop to avoid damage.

7. Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al., in view of Shacham-Diamand, Wilson et al., and Sherman.

8. Regarding Claims 12 and 13, Lopatin et al. disclose a method for manufacturing a semiconductor device, comprising the steps of:

forming a cobalt containing layer (CoWP) (60) (See Figure 4) (60) (Col. 5, lines 52 – 58) on a conductive copper member (40,53).

Lopatin et al. do not disclose the formation of a cobalt silicide layer on the surface of the cobalt including layer, using a silane gas atmosphere. Levinstein et al. disclose the formation of a cobalt silicide layer by evaporation, as discussed for Claim 1. The formation of layers in a silane gas system is well established in the art. Fowler et al., for example disclose the use of silane gas in a system as a source of silicon (Col. 3, lines 15 – 23) for deposition. It would have therefore been obvious to one of ordinary skill in the art at the time of the invention to combine Levinstein et al. and Fowler et al. with Lopatin et al. to obtain a process stable layer over the cobalt including layer for device stability.

Lopatin et al. do not disclose the formation of a silicon oxide by adding oxygen to silane

In a reaction process. However, the formation of silicon oxide on a semiconductor surface

Art Unit: 2811

using a mixture of silane and oxygen in a reaction process has been utilized for many decades and is notoriously well known in the art (See for example, Sherman, p. 67, 1<sup>st</sup> par.) Hence, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine Sherman with Lopatin et al. to obtain a silicon oxide layer formed by an oxygen/silane reaction for use as a passivation or scratch protection layer (p. 66, 2<sup>nd</sup> par) on the cobalt silicide.

### ***Response to Arguments***

9. Arguments of Applicant have been carefully considered but these have been found to be moot in terms of the new ground(s) of rejection. However, a few comments can be made regarding other arguments. Applicant's assertion (pp. 8 – 9) that Lopatin avoids the use of oxide is not correct. This was discussed in detail in the previous Office Action. Lopatin is referring to the use of a dielectric adjacent to a copper layer (Figure 1) and discloses that an adjacent low k material is preferred. He is not disclosing an oxide layer atop a silicide layer. It should be noted that oxides, as passivants on cobalt silicide, have been used, as discussed in the Office Action.

Arguments relating to Claims 6, 12, and 13 have been addressed above. Similarly, arguments relating to the "oxide layer" and the CoSi layer have been addressed above and in the previous Office Action.


### ***Conclusions***



Art Unit: 2811

10. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to **Thomas Magee**, whose telephone number is **(703) 305 5396**. The Examiner can normally be reached on Monday through Friday from 8:30AM to 5:00PM (EST). If attempts to reach the Examiner by telephone are unsuccessful, the examiner's supervisor, **Eddie Lee**, can be reached on **(703) 308-1690**. The fax number for the organization where this application or proceeding is assigned is **(703) 872-9306**.

Thomas Magee  
December 19, 2003



EDDIE LEE  
SUPERVISORY PATENT EXAMINER  
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